Armed Forces College of Medicine

AFCM

Innate Immunity
(Part 2)

Dr.Alaa Ahmed Aly
Professor of Microbiology & Immunology

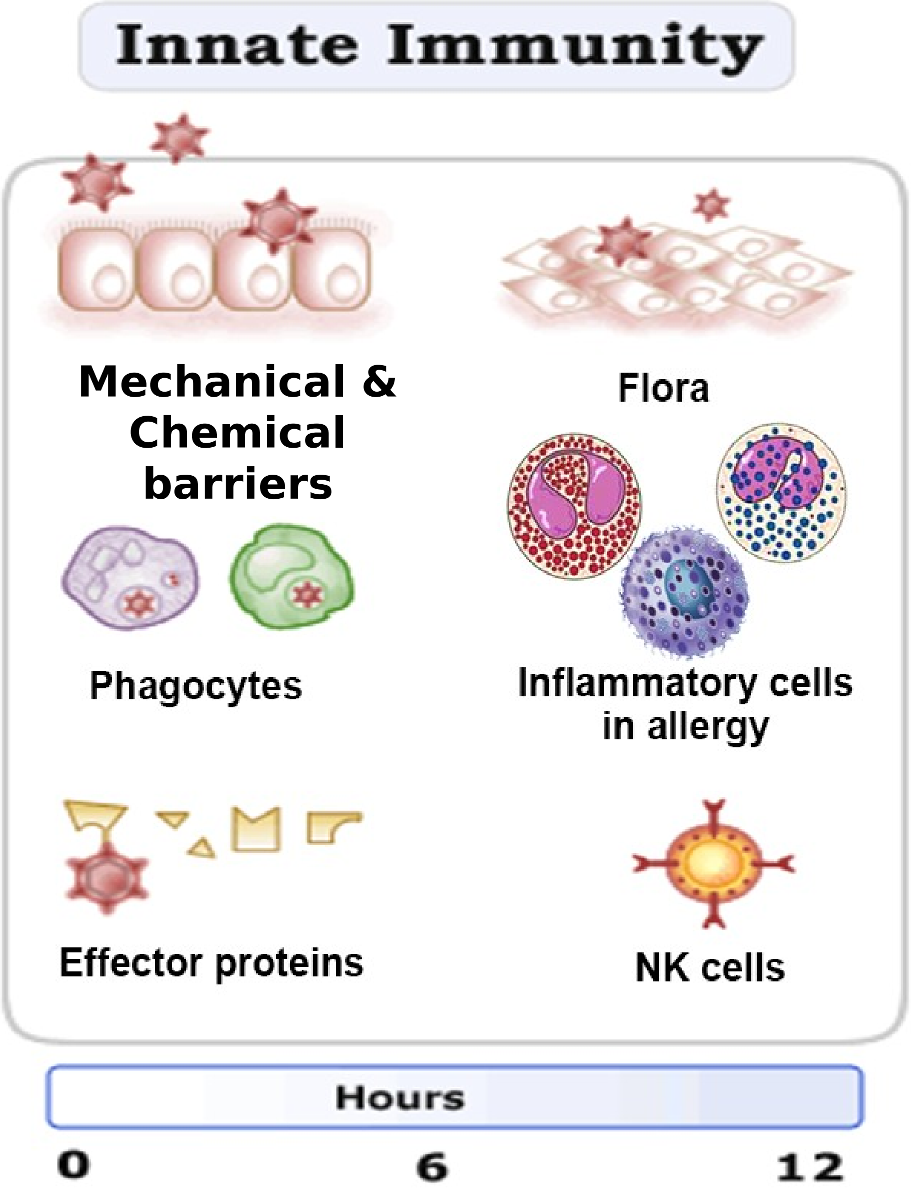
Intended learning objectives (ILOs) of Introduction to Immunology

By the end of this lecture the student will be able to:

1. ***Describe functions and components of innate immunity***
2. ***Outline functions of 1ry & 2ry lymphoid organs***
3. ***Compare characters of innate immunity to those of adaptive immunity*.**

Components & Reactions of Innate Immunity

- Mechanical & Chemical barriers
- Normal Microbial flora
- Inflammation
- Phagocytes & Phagocytosis



III) Phagocytes & Phagocytosis

A) Neutrophils

B) Monocytes & MQ

C) Dendritic cells

A) Neutrophils

➲ Site & Circulation

- **Most abundant WBCs in blood**

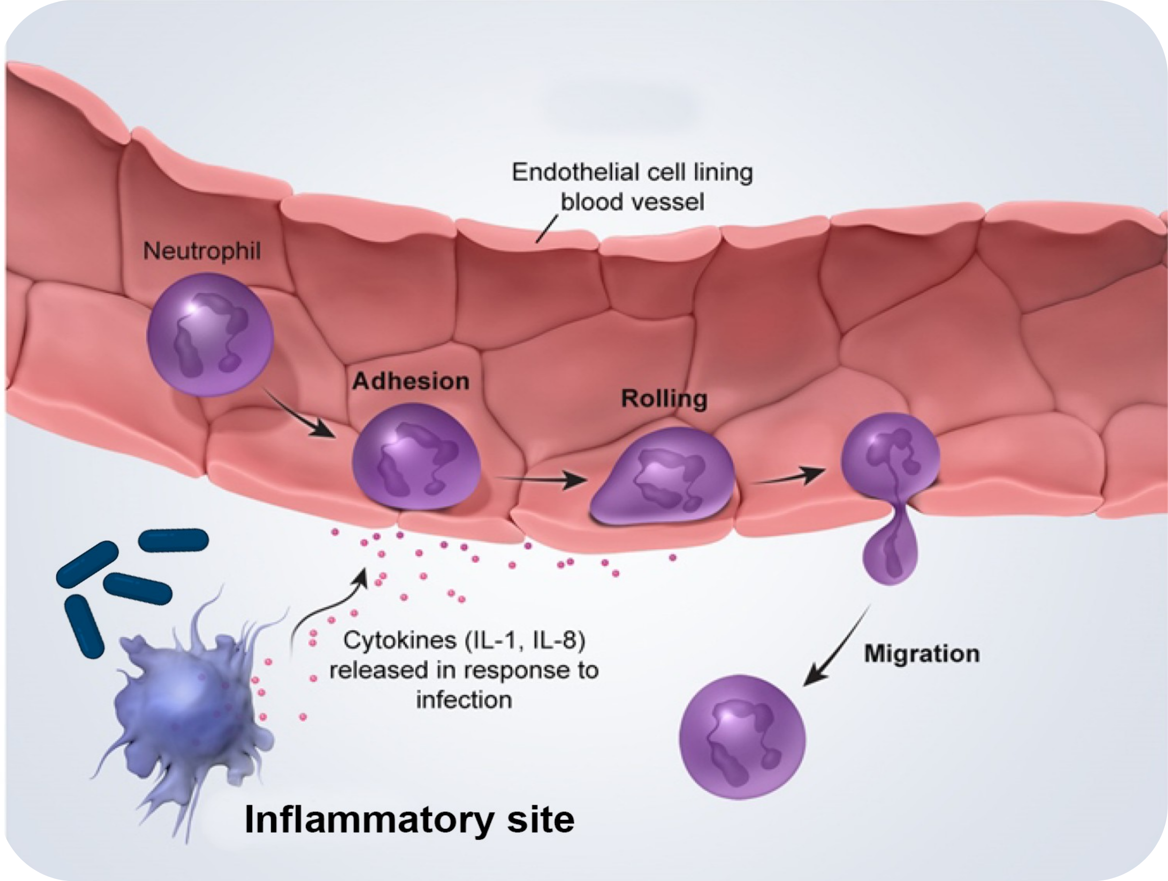
↓

1st phagocytic cells that encounter infection in blood تتجمع

- **Recruited (migrate) from blood into tissues**

(during inflammation)

- ↑ ↑ number in blood in **bacterial or fungal infections**


Endothelial cell lining blood vessel
Neutrophil
Adhesion
Rolling
Cytokines (IL-1, IL-8) released in response to infection
Migration
Inflammatory site

A) Neutrophils

➲ Granules

Lysosomes contain microbicidal substances :

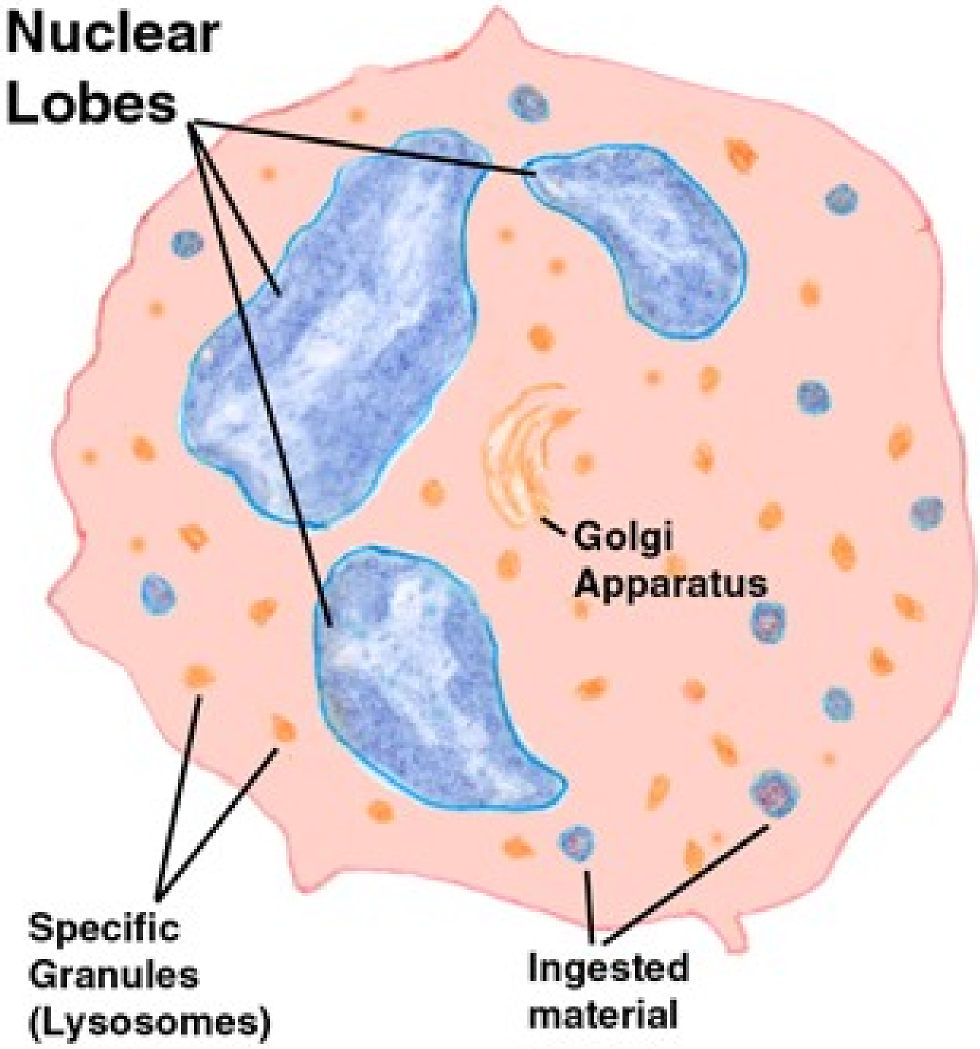
قاتلة للميكروبات

e.g. **-** Lysosymes, Defensins (LD)

- Elastases, proteases

➲ Functions

Phagocytosis



B) Monocytes & MQ

➲ Site & Circulation

Monocytes circulate in **blood**

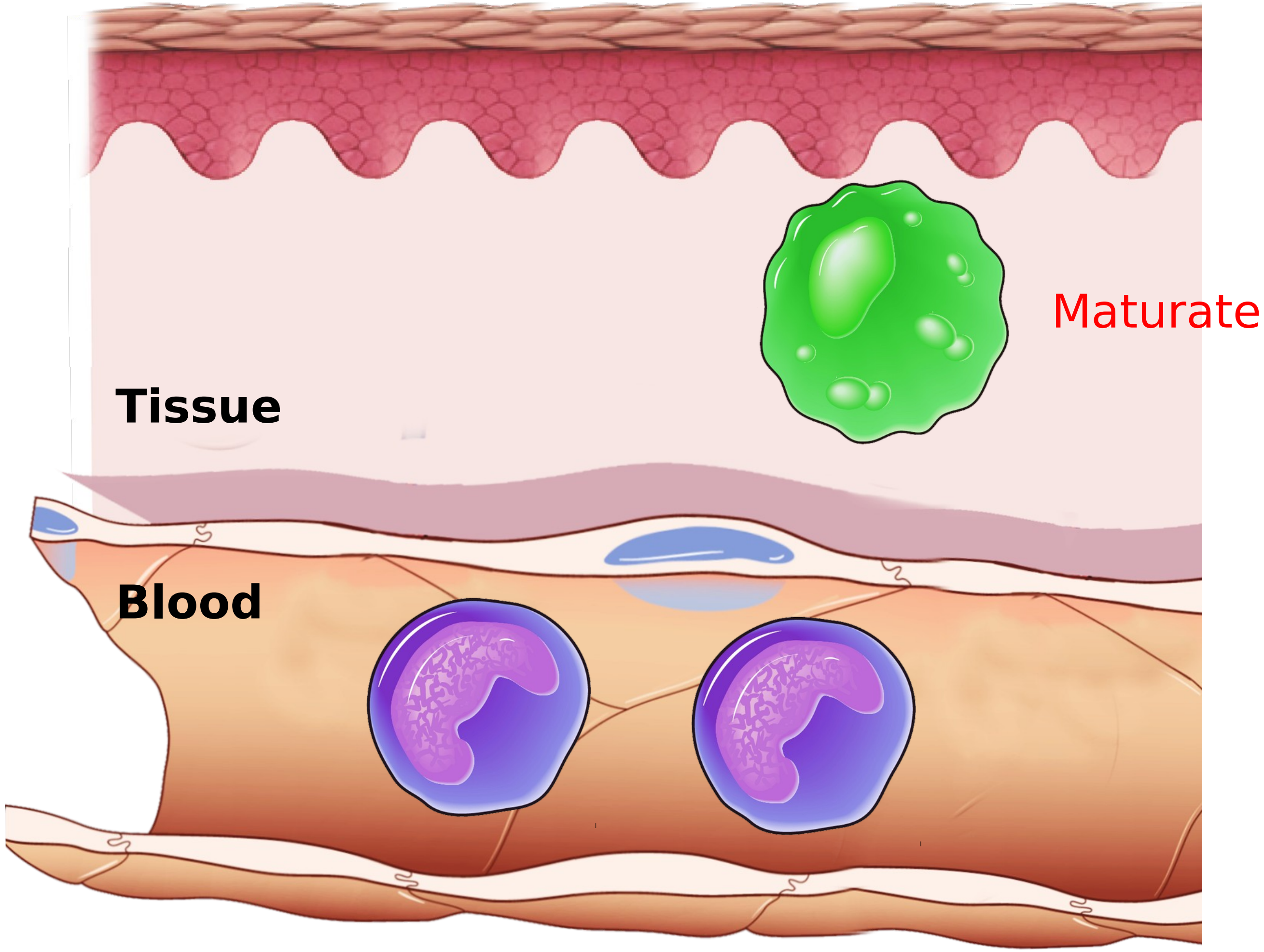
↓

Maturate into

resident macrophages (MQ)
in tissues

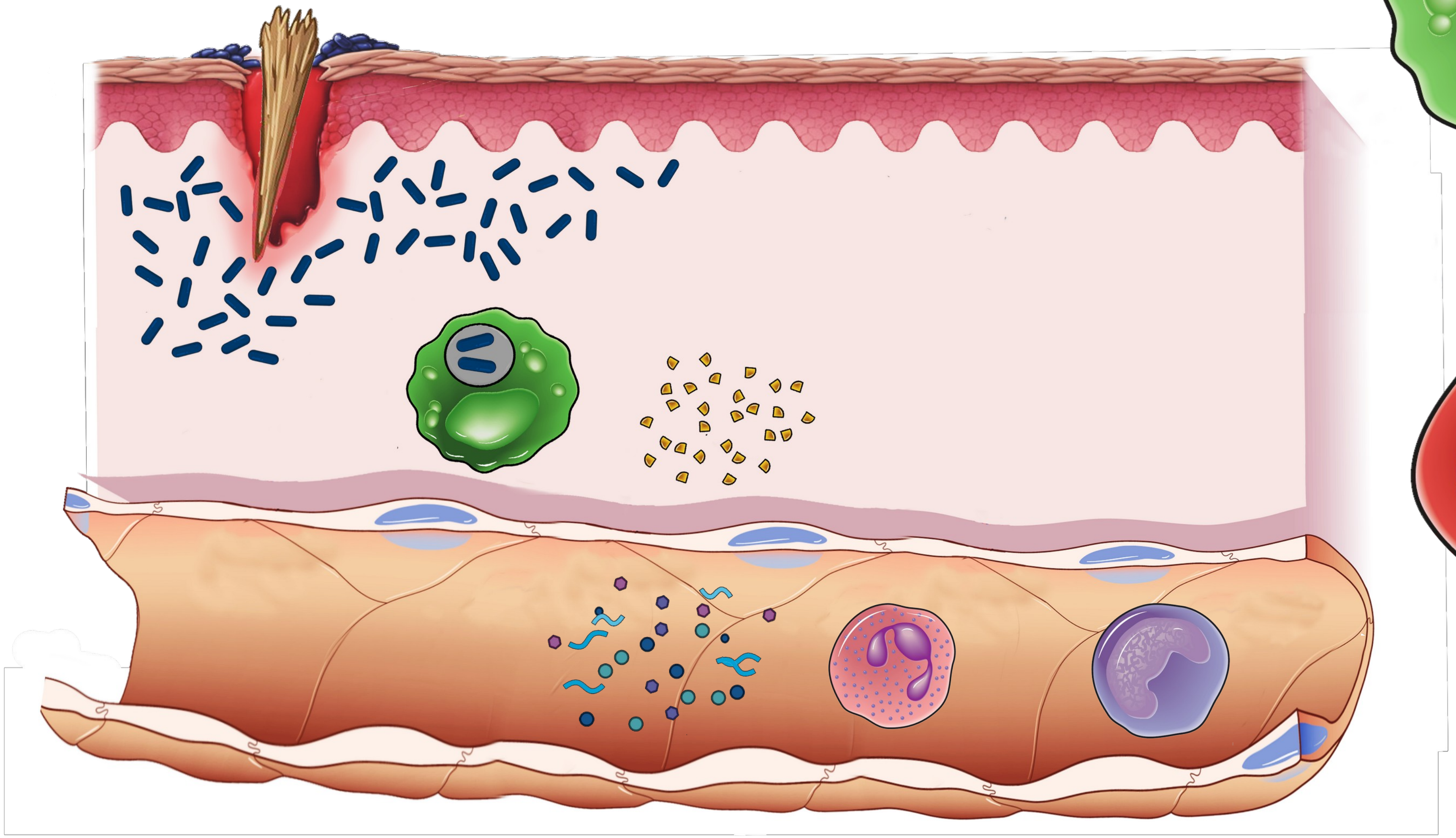
➲ Granules

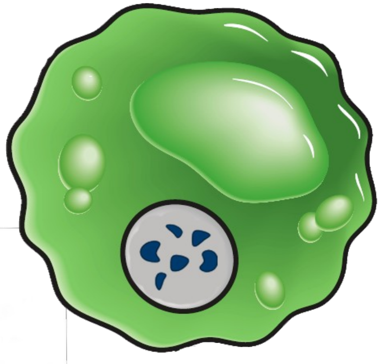
Lysosomes

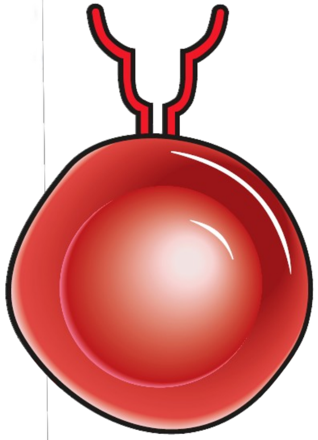


B) Monocytes & MQ

➲ Functions







B) Monocytes & MQ

➲ Site & Circulation

Monocytes circulate in **blood**

↓

Maturate into

resident macrophages (MQ) in tissues

➲ Granules

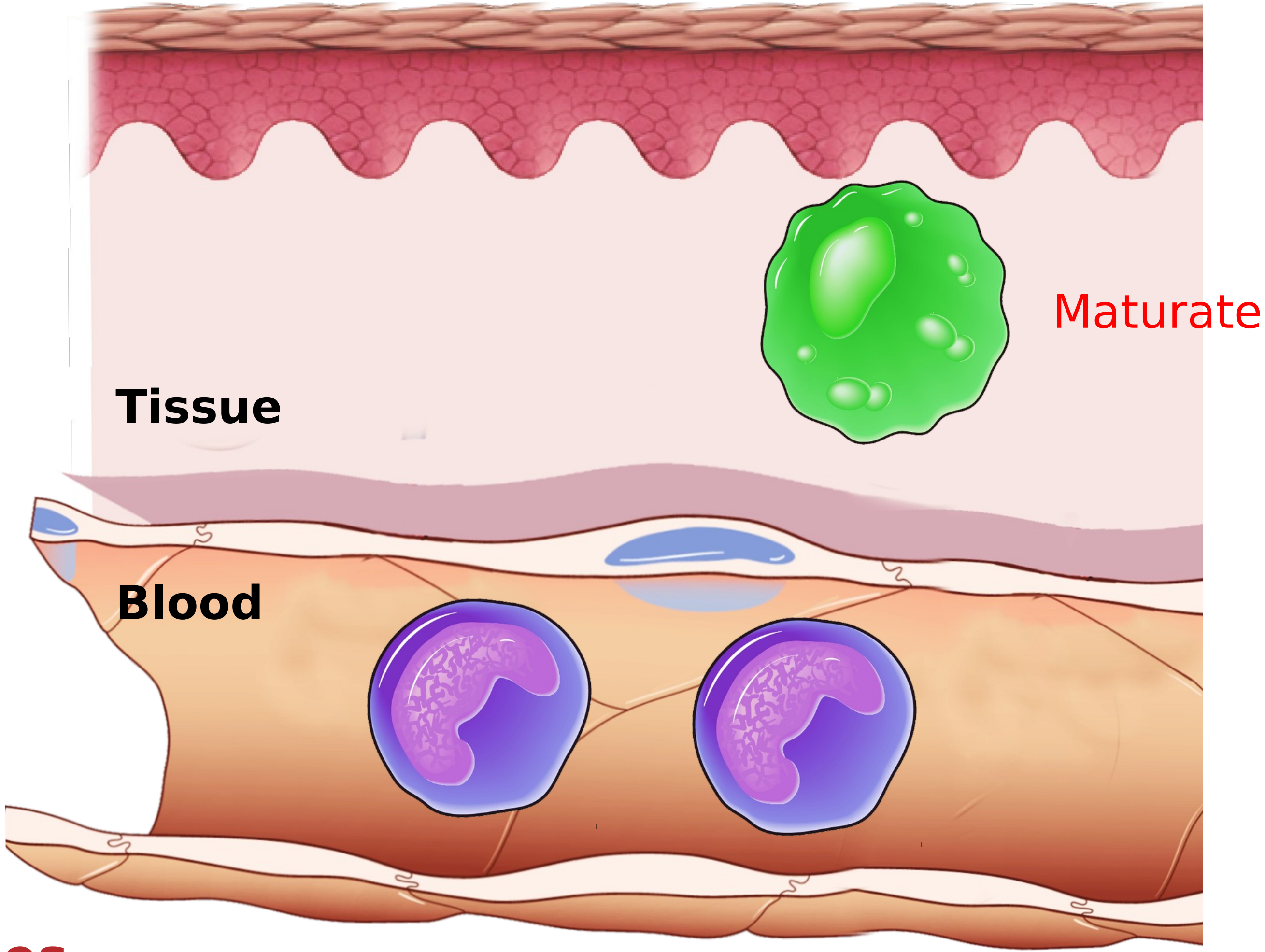
Lysosomes

➲ Functions

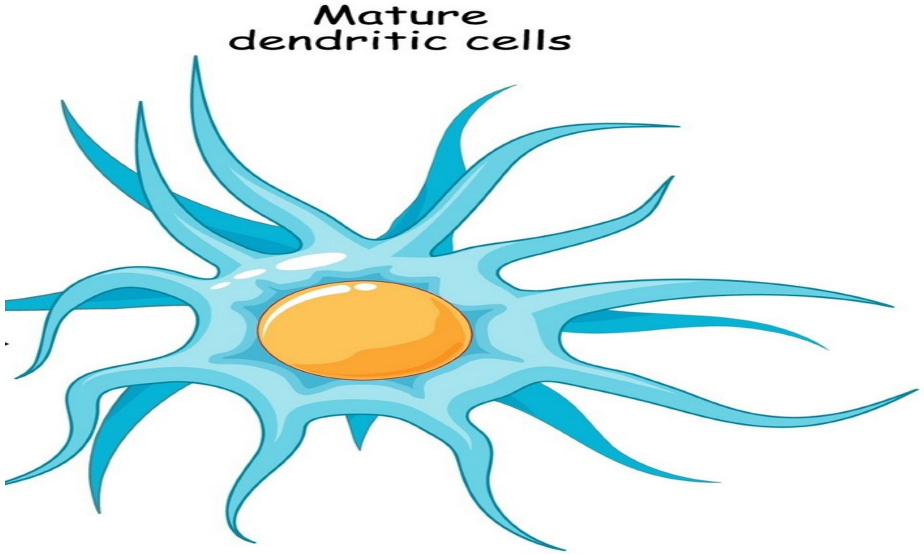
1) **Phagocytosis**

2) **Production of inflammatory cytokines**

3) **Antigen presenting cell (APC)** ➜ Activates T cell



C) Dendritic cells



ام 44

رحالة

C) Dendritic cells

➲ Site & Circulation

1) Skin

2) RT & GIT mucosa

❖ **Migratory cells :**

travel to lymph nodes & spleen

↓

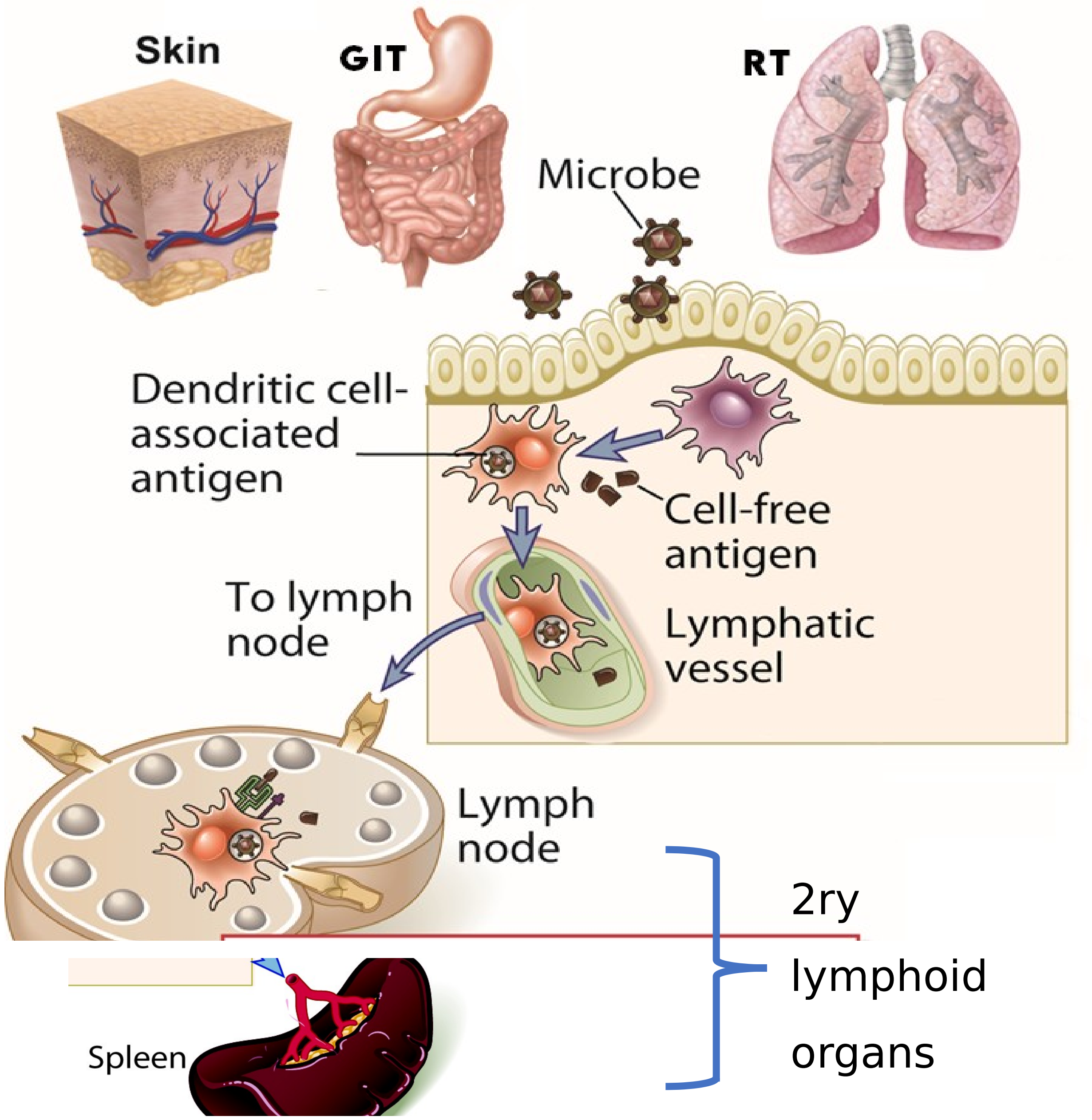
Activate T lymphocytes

(main APC)

➲ Granules

➲ Functions

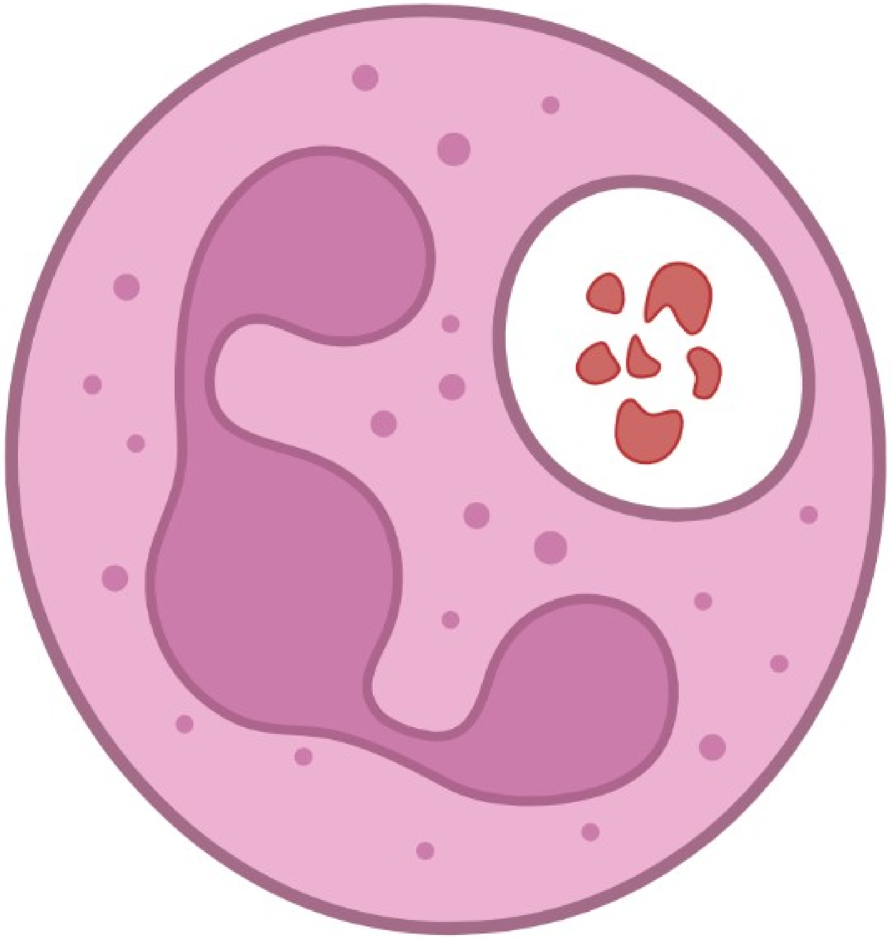
} As macrophage



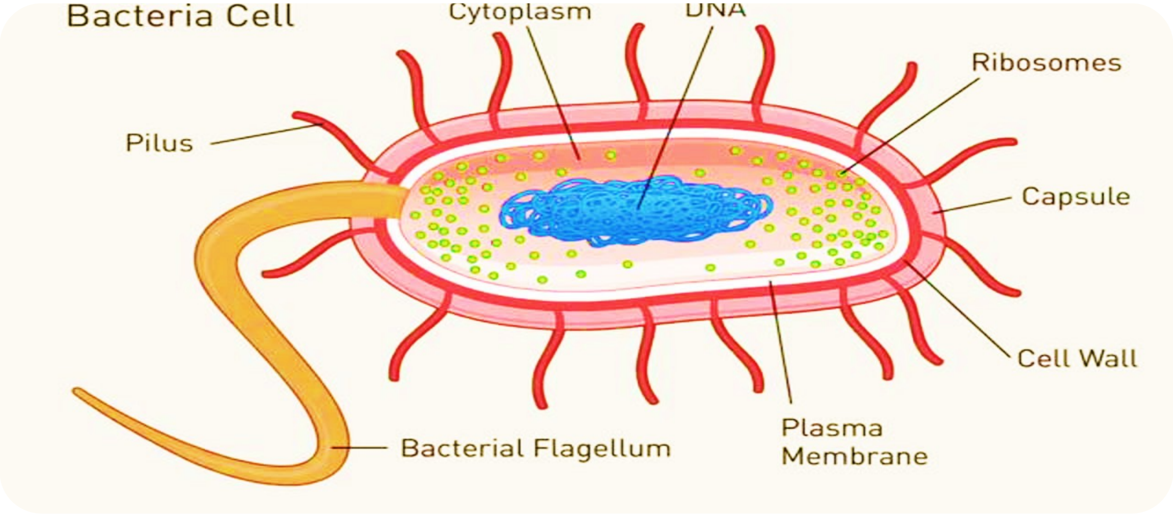
2ry lymphoid organs

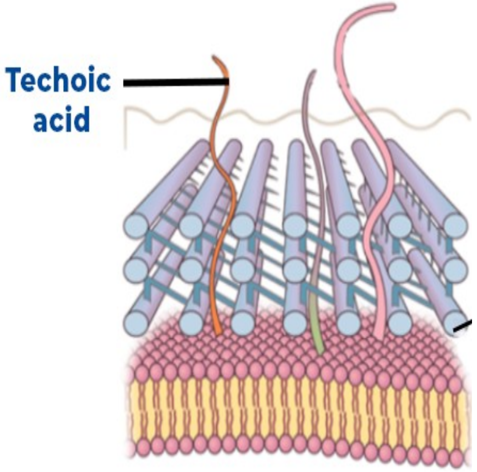
Steps of phagocytosis

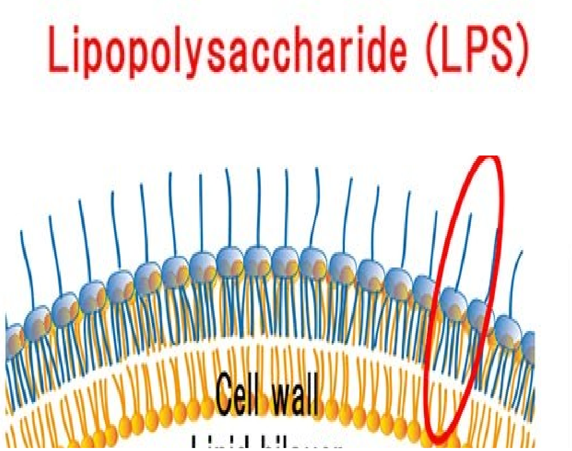
- **A** Recognition of microbes
- **B** Uptake
- **c** Intracellular killing



Recognition of microbes







Pathogen associated molecular patterns (PAMPs):

انماط جزيئية للمرض مصاحبة

- Characteristic structures of microbes (not present in mammalian cells) e.g

1) Bacterial: ● Lipopolysaccharides (LPS)
● Teichoic acid

2) Viral : nucleic acid

PRRs
Pattern Recognition Receptors

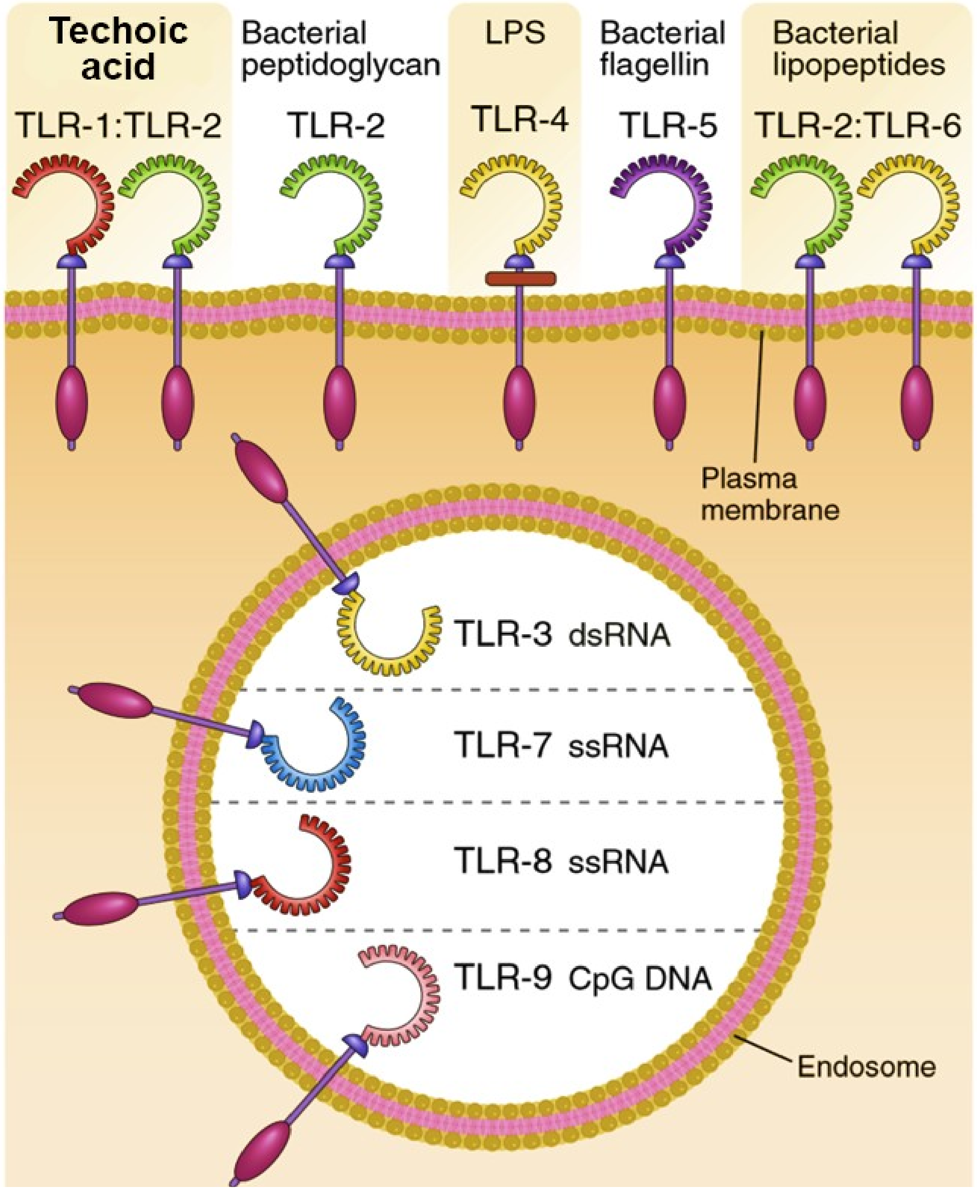
Recognition of microbes

By Pattern recognition receptors (PRRs)

e.g Toll like receptors (TLRs)

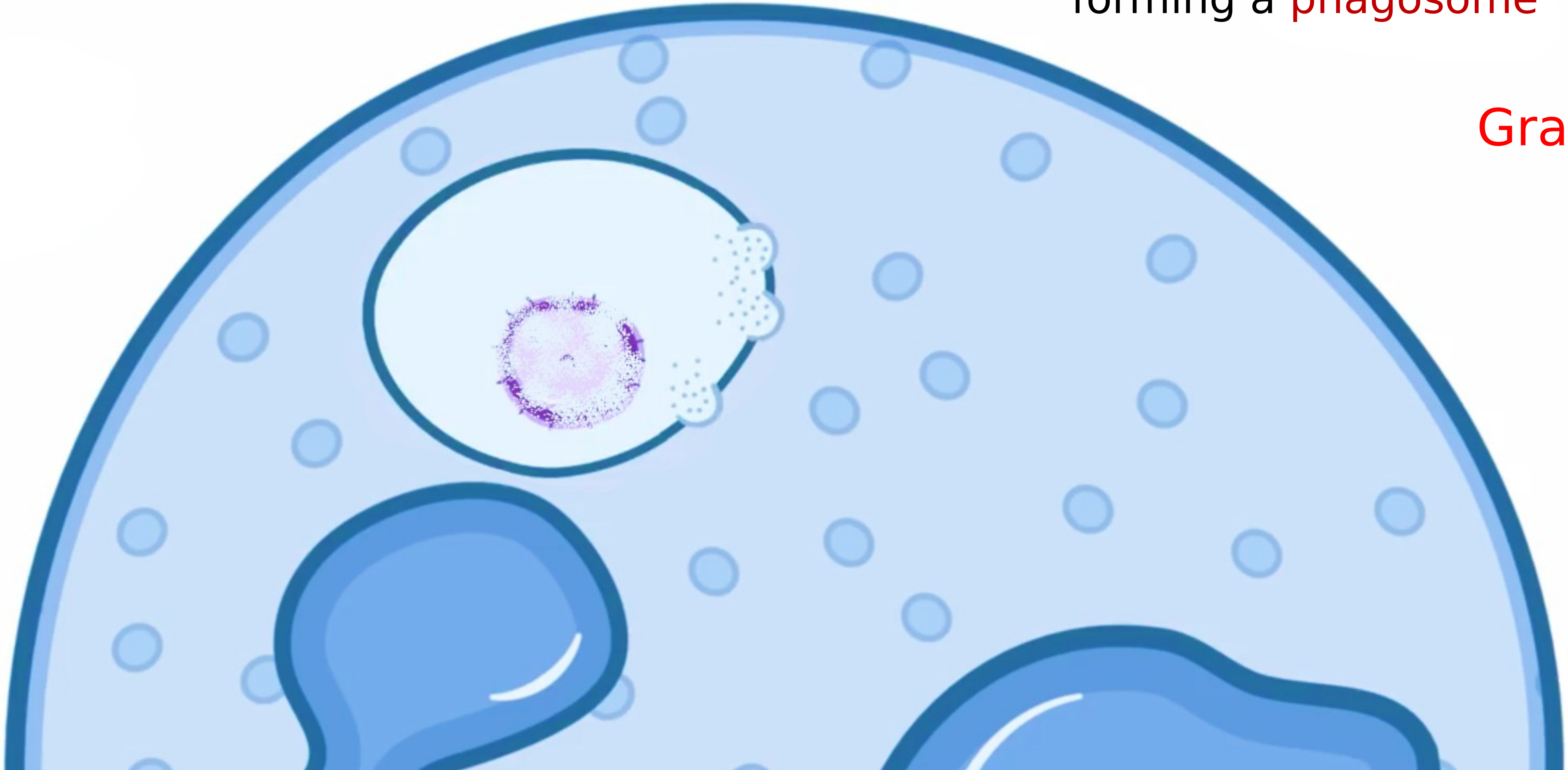
- **Functions of PRRs:** Recognize

pathogen associated molecular patterns (PAMPs):



Uptake

Phagocyte cell membrane surrounds the organism forming a phagosome



Intracellular killing (in phagolysosome)

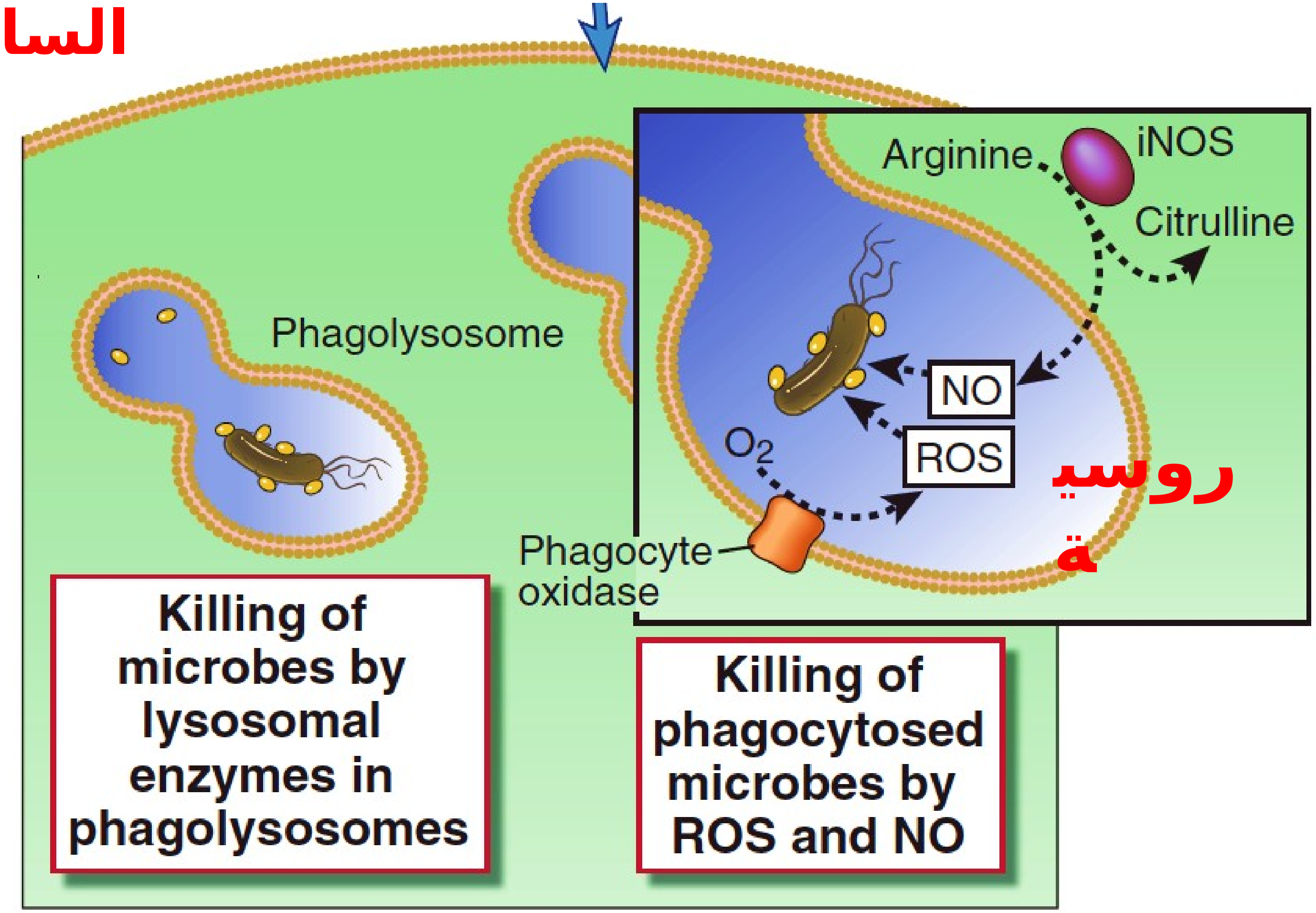
Oxidative killing

Oxidase
converts O_2
into reactive O_2 species (ROS):
O_2^- & H_2O_2
↓
Killing of microbe

مشتقات الاوكسجين
السامة

Non oxidative Killing

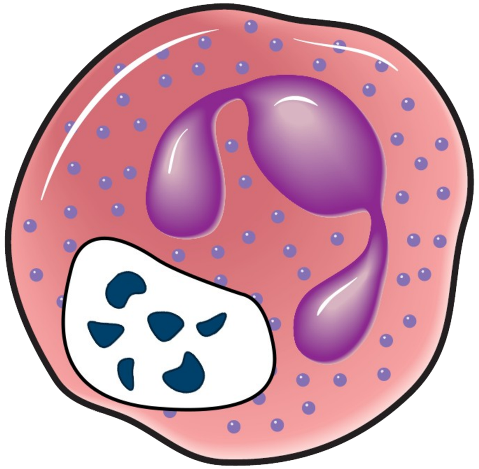
By proteolytic enzymes
in phagolysosomes e.g elastase
↓
Destruction of microbes

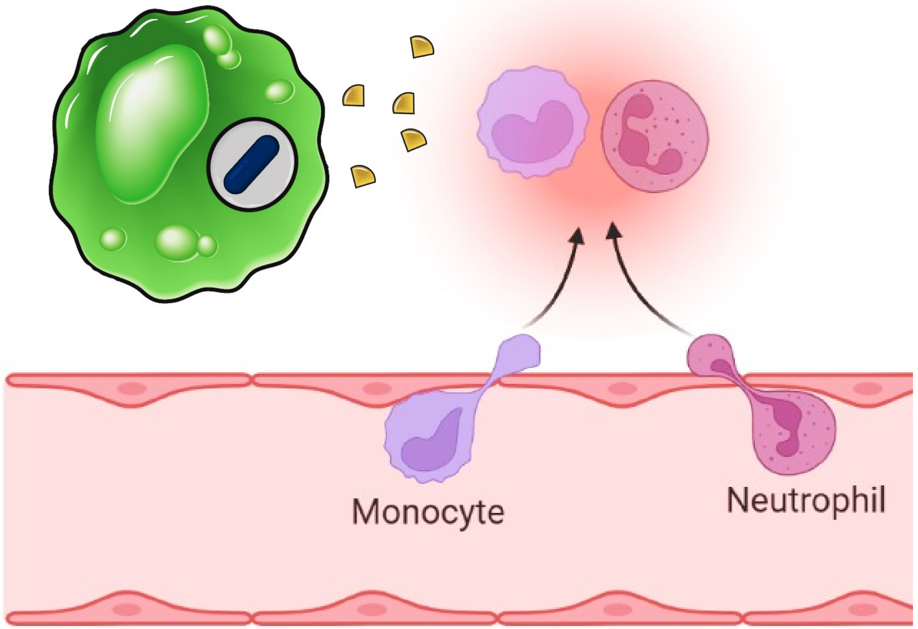

Phagolysosome
Arginine
iNOS
Citrulline
NO
ROS
O_2
Phagocyte oxidase
روسي
ة
Killing of microbes by lysosomal enzymes in phagolysosomes
Killing of phagocytosed microbes by ROS and NO

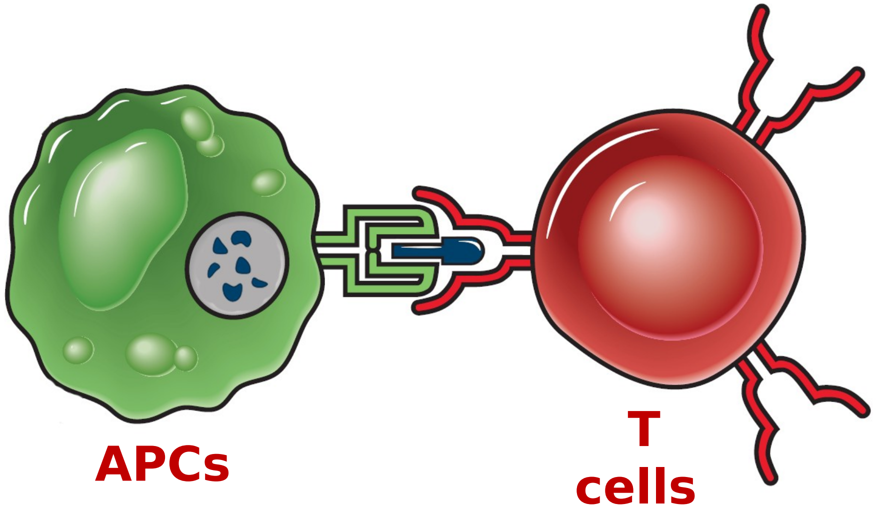
III) Phagocytes & Phagocytosis

Outcome of phagocytosis

Neutrophils	Dendritic cells & Macrophages	
Destroy microbes completely	Production of inflammatory cytokines ↓ Inflammation	Present Ag to T cells (APCs) ↓ Initiation of adaptive immunity







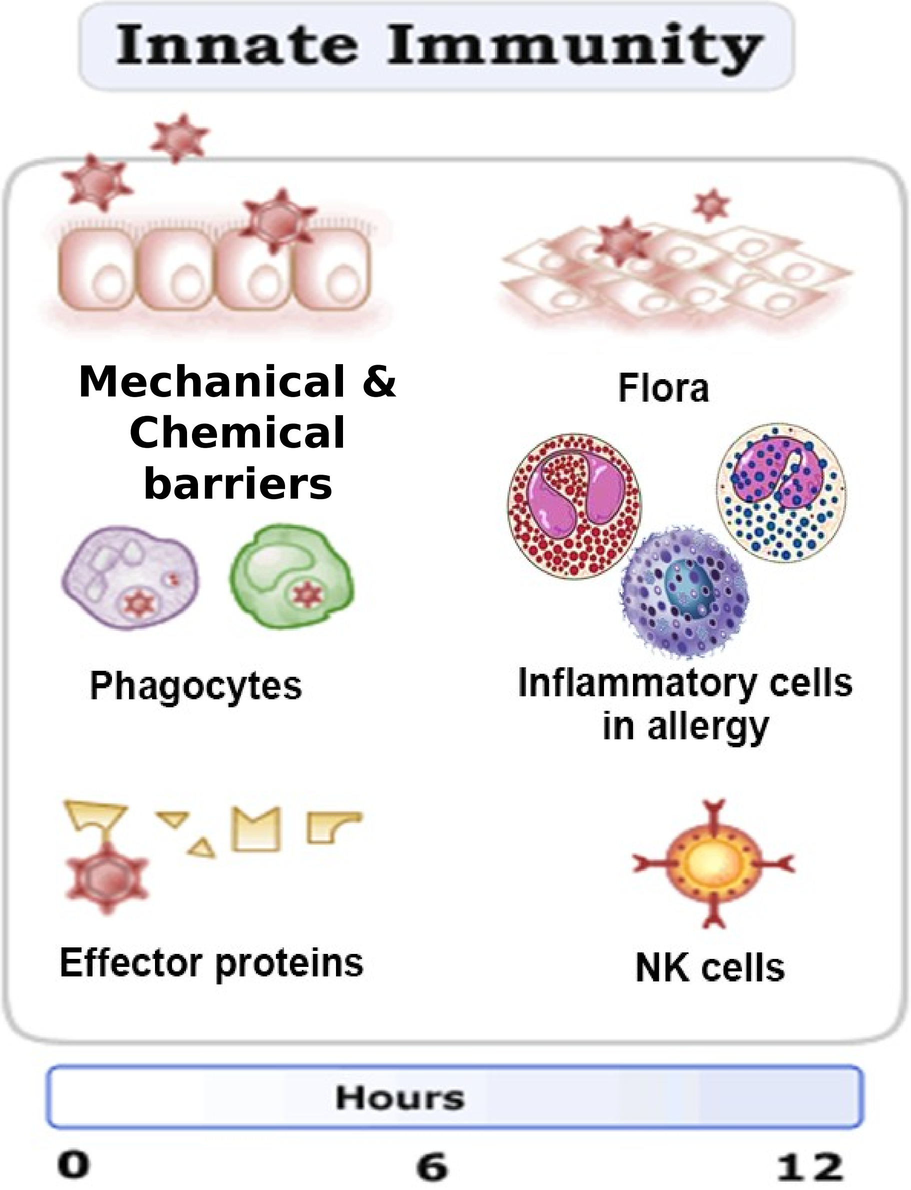
Quiz 2

What is the main Ag presenting cells?

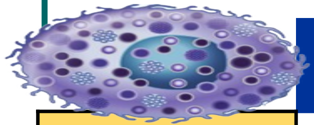
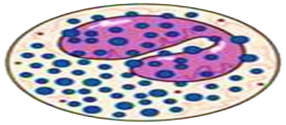
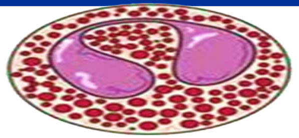
A. Neutrophils
B. Eosinophils
C. Monocytes
D. Macrophages
E. Dendritic

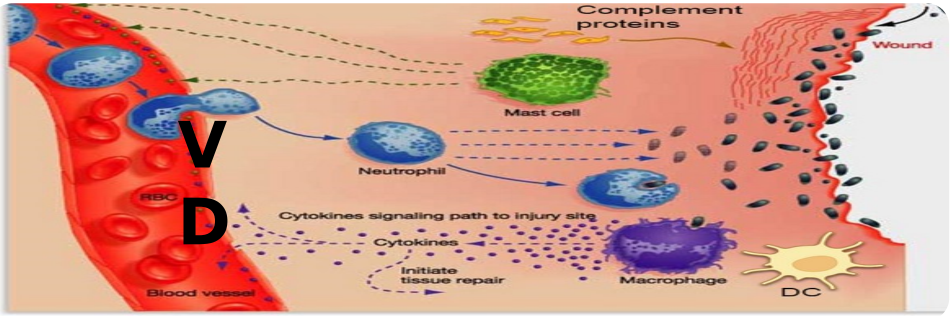
Components & Reactions of Innate Immunity

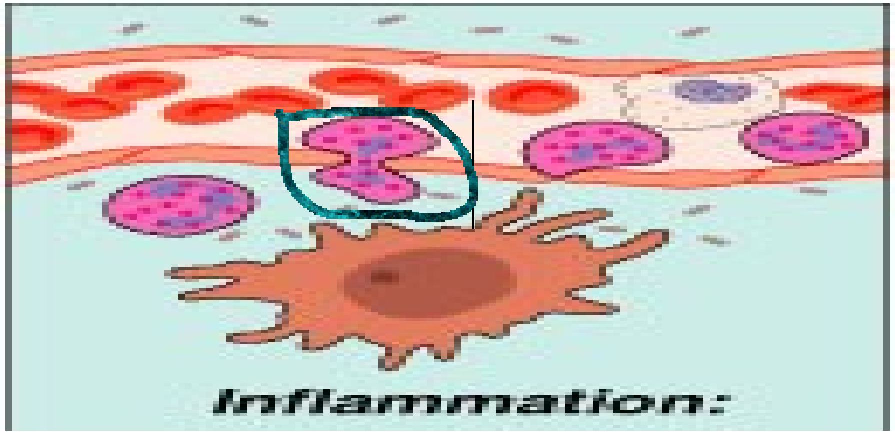
- Mechanical & Chemical barriers
- Normal Microbial flora
- Inflammation
- Phagocytes & Phagocytosis
- Inflammatory cells involved in allergy

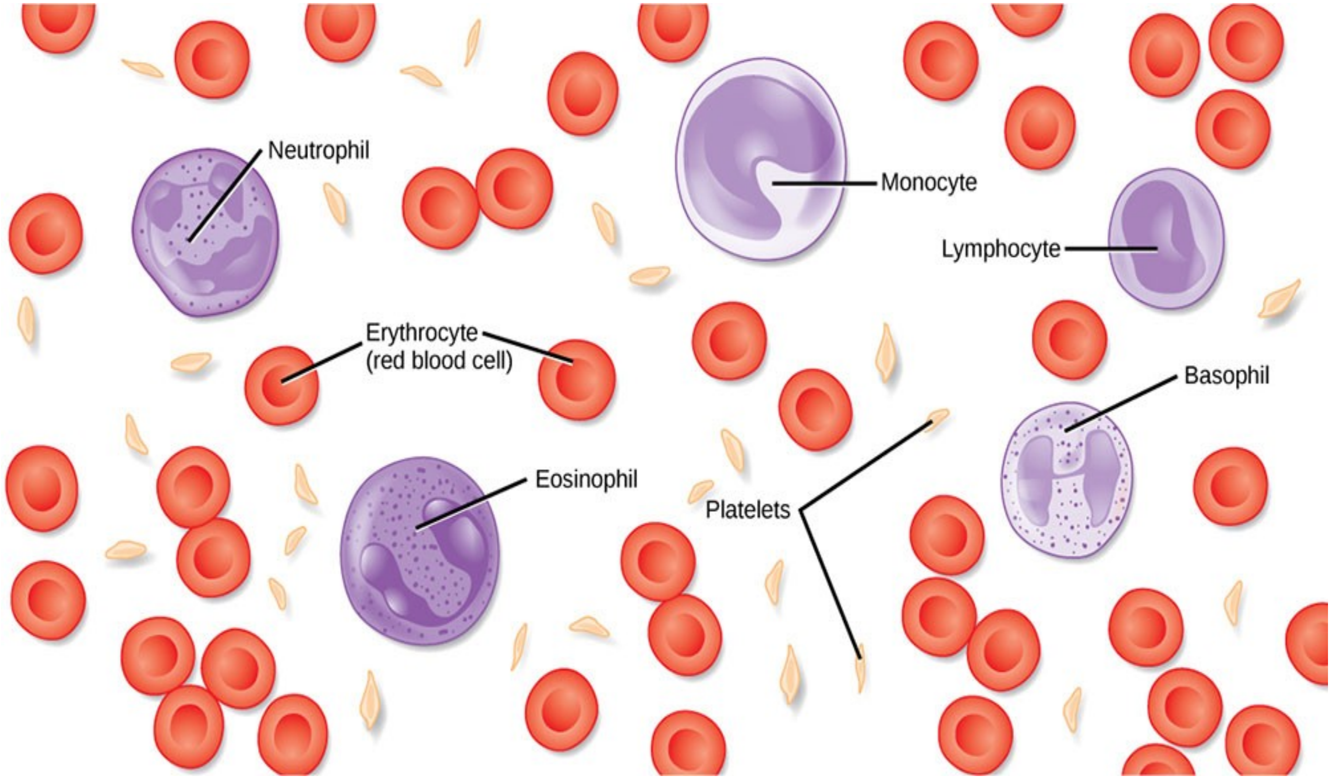


IV) Inflammatory cells involved in allergy

	Mast cells	Basophils	Eosinophils
Site	Fixed in tissues : skin, GIT & RT mucosa		In blood ➜ 
		Recruited (migrate) into tissues (during inflammation)	
Granules	Contain Histamine (induces vasodilation), cytokines		Contain cytokines & toxic protein



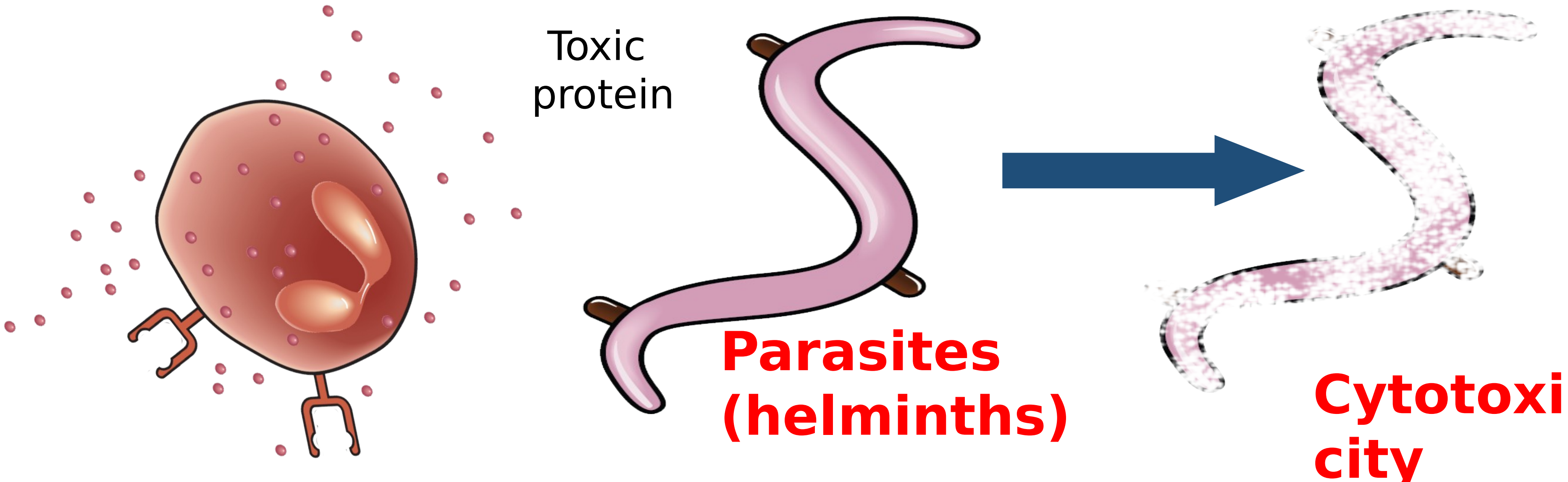




IV) Inflammatory cells involved in allergy

	Mast cells	Basophils	Eosinophils
Role in immunity	1) Inflammation in mucosa 2) Have a role in hypersensitivity (allergy) 		
			3) Cytotoxicity (EC killing) of helminths(parasites): by toxic protein

- ↑ number in blood in parasitic infections



- ↑ number of neutrophils in blood in bacterial & fungal infections

- ↑ number of eosinophils in blood in parasitic (helminthic) infections

- ↑ number of lymphocytes in blood in Viral infections